

MULTIPLE FOCAL CONTACT LENS

This application is a continuation of application Ser. No. 536 filed Jan. 5, 1970, now abandoned, which is a continuation-in-part of application Ser. No. 632,398, 5 filed Apr. 20, 1967, now abandoned.

This invention relates to contact lenses and is particularly directed to a contact lens having continuous focal characteristics.

Bifocal contact lenses have previously been produced. Such lenses generally follow the design of bifocal lenses employed in conventional eye glasses in that a more or less definite line of demarcation is provided in the bifocal lenses. The wearer of the lenses must look through one portion of the lens for achieving distance vision and through another portion of the lens for achieving close vision.

In the case of conventional eye glasses, the wearer can generally accommodate to bifocal lenses without undue difficulty. Usually, the wearer will look straight ahead through an upper portion of the lens for distance vision and will lower his eyes for looking through the lower portion of the lenses for close vision.

Bifocal contact lenses have been designed for use in substantially the same manner. A much more difficult problem is encountered, however, with respect to training the wearer to adjust for distance and close vision. Since the lens rides directly on the eye, there is obviously a very limited area for eye movement whereby one portion of the lens can be employed in preference to another portion. Furthermore, any shifting of the lens position on the eye will require a corresponding adjustment of the wearer further complicating the use of the lenses.

Pinhole contact lenses have been proposed, for example, as discussed in an article entitled "Bifocal Contact Lenses" published in the Precision-Cosmet Digest, March, 1962, pp. 1-6. The conclusions reached, however, are that this type of lens adversely affects peripheral vision, vision when the lens is decentered, and illumination and, therefore, has very limited potential.

It is a general object of the instant invention to provide a contact lens construction which will provide continuous focal characteristics while eliminating many of the difficulties encountered in the use of previously designed bifocal contact lenses.

It is a further object of the instant invention to provide a continuous focal lens of the type described which can be manufactured and fitted without undue difficulty thereby enabling prescription of the lenses at a relatively low cost.

It is a still further object of this invention to provide a continuous focal lens utilizing in part a pinhole principle along with important additional features which eliminate difficulties previously experienced and which thus provide a practical continuous focal lens.

It is a still further object of this invention to provide a contact lens of the type described which can be readily manufactured as cosmetic lens.

These and other objects of this invention will appear hereinafter and for purposes of illustration, but not of limitation, specific embodiments of the invention are shown in the accompanying drawings in which:

FIG. 1 is a cross-sectional view of a lens of the type produced in accordance with the features of the instant invention; and,

FIGS. 2 through 10 illustrate a variety of designs for pupil areas of lenses adapted to be employed in accordance with the concepts of this invention.

The lens of the instant invention may comprise a conventional construction, for example of the type disclosed in Touhy U.S. Pat. No. 2,510,438. Such lenses comprise so-called corneal lens constructions and have, generally speaking, a pupil area and a surrounding iris area. It will be understood that the invention is also applicable to contact lens designs other than the corneal type.

Pupil and iris areas are not precisely defined due to the fact that the pupil size changes with light conditions and because of different eye characteristics among patients. Accordingly, where reference is made to an "iris area" and a "pupil area" of the lens in the specification and claims, this should be understood to mean the usual areas of the lens which are superimposed over the pupil and surrounding iris under normal lighting conditions, and these are well known to experienced practitioners.

The specific contact lens of this invention defines a concave-convex shape with the concave surface being adapted to adhere to and float on the cornea. The concave surface has a curvature which substantially conforms to the cornea; however, in this connection, precise conforming of the respective curvatures is not achieved. This is partly due to practical limitations in manufacturing; however, deliberate variations are also provided for specific reasons. Thus, a definite deviation is provided near the center of the lens and cornea to insure the presence of a tear layer. Other deviations, particularly around the periphery are provided, for example, as discussed in the aforementioned Touhy patent.

In accordance with the principles of this invention, the pupil area of the lens comprises a centrally located, light transmitting opening. This opening is surrounded by an opaque region which occupies a portion of the pupil area and which may extend into the surrounding iris area. This opaque region is interrupted by light transmitting openings located in the pupil area. Thus, light is passed through the lens in the centrally located area as well as through the light transmitting openings which interrupt the opaque region. A limitation is placed on the extent of the opaque region so that light is also passed through the lens beyond the outer limit of the opaque regions.

The centrally located light transmitting opening is provided with an optical correction in accordance with the distance vision requirements of the wearer. The lens which results from this combination has been found to provide the necessary distance vision requirements since the wearer automatically will employ the centrally located light transmitting opening when viewing objects at a distance. Surprisingly, the combination described also provides for close vision even where no specific correction is made outside the area of the centrally located pupil opening. Thus, the distance correction may extend across the lens or no correction at all may be employed beyond the centrally located opening. Nevertheless, the light transmitting interruptions in the opaque region, in combination with the central opening, have been found to provide for close vision, adequate peripheral field, and satisfactory illumination, while the outer areas of the lens beyond the limits of the opaque region cooperate with the light transmitting